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ABSTRACT

The vapor pressure of yttrium was determined over the temperature range of 1100-1480°C by evaporation from a cylindrical crucible. The results are expressed by the equation

$$\log P_{mm} = -\frac{18500}{T} + 7.580.$$

Yttrium pressure was determined by Nesmiyanov et al. (ref. 1) on /214* samples with a high degree of purity (99.9 percent). The same authors later determined the yttrium pressure in samples with gas impurities not exceeding 0.1%. The results obtained in references 1 and 2 differ by more than one order. This difference, according to the authors, is due to the presence of volatile suboxides.

Ackerman (ref. 3) determined the rare yttrium vapor pressure by the continuous method and the simultaneous control of the vapor composition on a mass spectrometer. It was found that the vapor phase on a level with Y contains molecules of the YO ($\sim$ 1%) oxide which dissociates and does not affect the results.

The figure shows results achieved in determinating vapor pressures of hard and rare yttrium by comparison.

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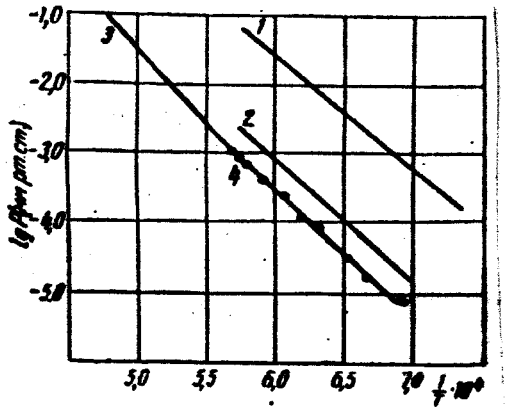
* Numbers given in margin indicate pagination in original foreign text.



Yttrium vapor pressure and temperature relationship

1, 2, data obtained by Nesmeyanov on yttrium; 3, data obtained by Ackerman on rare yttrium; 4, the authors' data.

In this study the saturated vapor pressure of yttrium was determined over a temperature range of 1100-1480°C. The 99.9 percent pure yttrium produced by the vacuum distillation method was used for measuring purposes.

Methods employed (ref. 4) made it possible to measure the yttrium vaporization rate within the mentioned temperature range without affecting the vacuum which was maintained at a level not lower than $2 \cdot 10^{-6}$ mm Hg. The temperature was measured with an optic pyrometer, correct to ± 5°. The yttrium was vaporized in tantalum crucibles. The sublimation rate at each temperature was measured 3-4 times, and the results were averaged.

Resulting data are listed in the table. The vapor pressure was calculated by the following formula /215

$$P = G\left(\frac{1}{K} - 1 + \frac{1}{\alpha}\right)\sqrt{\frac{2\pi RT}{\mu}},$$

where G is the vaporization rate in $g/cm^2 \cdot$ sec, K the Klausing coefficient and a the vaporization factor.

Temperature °K	vaporization rate $g \cdot cm^{-2} \cdot sec^{-1}$	vapor pressure, mm Hg.
1433	$9.10 \cdot 10^{-8}$	$6.30 \cdot 10^{-6}$
1503	$1.71 \cdot 10^{-7}$	$1.21 \cdot 10^{-5}$
1533	$4.35 \cdot 10^{-7}$	$3.10 \cdot 10^{-5}$
1583	$1.23 \cdot 10^{-6}$	$8.66 \cdot 10^{-5}$
1613	$1.39 \cdot 10^{-6}$	$1.01 \cdot 10^{-4}$
1643	$4.00 \cdot 10^{-6}$	$2.98 \cdot 10^{-4}$
1688	$5.30 \cdot 10^{-6}$	$3.96 \cdot 10^{-4}$
1723	$9.05 \cdot 10^{-6}$	$6.83 \cdot 10^{-4}$
1738	$1.13 \cdot 10^{-5}$	$8.56 \cdot 10^{-4}$
1753	$1.44 \cdot 10^{-5}$	$1.10 \cdot 10^{-4}$

The figures in the table and the method of least squares were used to calculate an equation for defining the pressure of saturated yttrium vapor in the 1100-1480°C temperature range:

$$\lg P_{mm} = -\frac{18500}{T} + 7580.$$

The heat of sublimation, calculated on the basis of this equation, is 84.5 kilocal/mole. The results obtained agree with the data in reference 3.

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